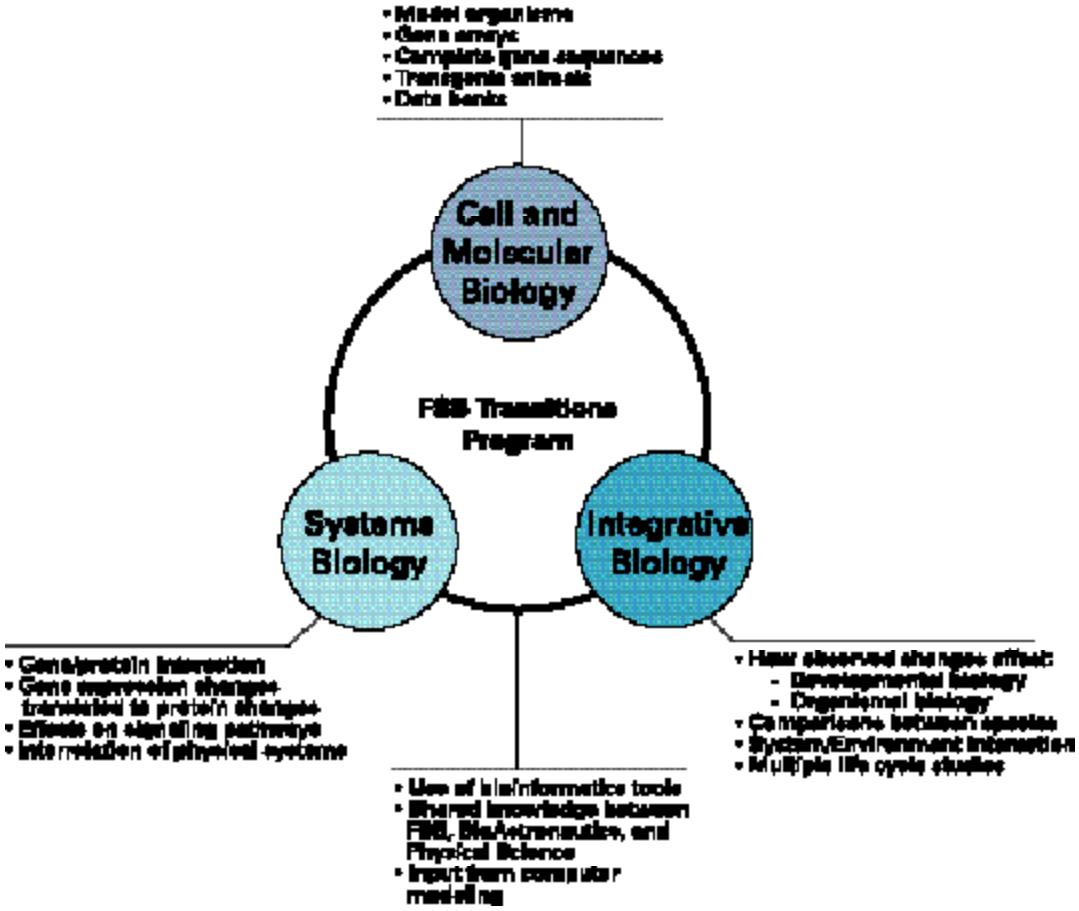
Summary

Space Biology 2002-2007

- Survey the genomics, proteomics, physiology, and structure of model organisms that pioneered the Human Genome Project.
  - Begin with easy to handle organisms -- cells, microbes, nematodes, arabidopsis.
  - Build to mammalian species as resources mature.
  - ***Build a lexicon of biological responses in space.***
- Survey human and rodent model tissues relevant to space medicine.
  - Build a quartet of relationships between human vs. rodent cell cultures then correlate results in whole animals later in Station development.
  - ***Build reference standards for space medicine, radiation studies.***
- Return value to the taxpayer.
  - Investigate cell, tissue, and small organism biology that offers the greatest benefits for terrestrial applications.
  - Implement an education program.

FSB *Transitions* Implements an Integrated, Multidisciplinary Approach that Encompasses All Levels of Biological Organization



Summary

Approach: Amplify the Value of the Payload

- Space Biology Sample Return project:
  - Preserve samples via “Fix or freeze” for postflight analyses and archiving.
  - Apply latest technologies: Correlative genomics, proteomics, confocal imagery, 3+4D reconstruction
  - Characterize the sequence of events in space adaptation: Collect data at multiple time courses
  - Determine cause and effect relationships: preflight, inflight, postflight control strategies.
  - Use all available platforms: Shuttle, Station, free-flyers
  - Use all available hardware: Soda can, shoebox, microwave sized payloads
  - Continue to amplify information: bioinformatics, computational biology, integrative studies, data mining, biospecimen sharing, reference standards, sample and data archiving.

Summary

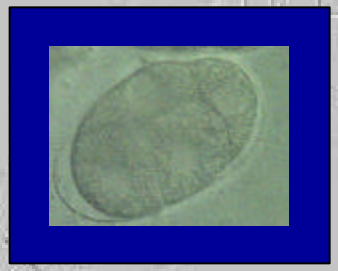
Approaches that Increase Community Involvement

- Space Biology Sample Return project:
  - Baseline data collection on Earth and space via selected consortia
  - NRAs targeted to available hardware and specific 5 year goals
  - Develop a Minuteman type program to take advantage of unexpected opportunities: Soda can, shoebox, microwave sized payloads
  - Develop a “Piggyback” program to make maximum use of vehicle resoruces.
  - Preserve samples via “Fix or freeze” for postflight analyses and archiving.
  - Continue to amplify information: bioinformatics, computational biology, integrative studies, data mining, biospecimen sharing, reference standards, sample and data archiving.

Summary
NEXT STEPS 2003

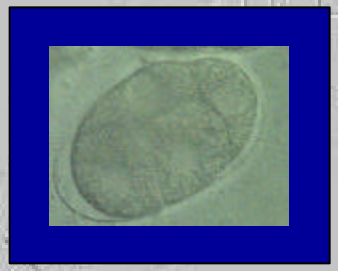
- Develop Plan *(in progress)*
- Demonstrate Feasibility v
- Identify investigations in queue that contribute to focused goals v
- Survey available hardware v
- Develop Baseline Data Collection Plan v
- Develop astronaut support *(in progress)*
- Solve the freezer, inflight imaging problem *(in progress)*
- Complete the bioinformatics framework *(in progress)*
- Release a focused NRA *(in progress)*
- Obtain manifest opportunities
- Procure selected flight units for baseline data collection
- Begin baseline data collection on model organisms
- Develop an “Astronaut Discovery Kit”

Summary
Schedule



Space Biology Outcomes

- Reveal the molecular biology of the only life that we know in its first generations beyond the planet of origin.
- Document the biological history of life's transition to space.
- Develop the first lexicon for biological responses in space.
- Identify fundamental processes enabling or hindering human explorations beyond Earth.
- Add NASA's wing to the growing library of bio data on "public domain" organisms.
- Open vast new areas for biological discovery.
- Inspire applications in medicine and commerce.
- Provide fascinating and educational insights into the nature of life in the universe.



Space Biology Conclusion

- The biotech revolution has also revolutionized space biology by amplifying the value of biosciences payloads orders of magnitude over what was possible just 5 years ago.
- The required spacecraft are flying.
- Enabling hardware is now available: more will be added over the next 5 years.
- *Transitions* delivers high quality results even under early Space Station era constraints.
- The knowledge obtained is pioneering and foundational to science, human exploration, and Earth applications.
- Nobel Laureate Baruch Blumberg has agreed to lead the science effort. A community has been developed.
- Ames is ready to support all phases of the implementation.
- The budget is very small for the expected impact.

This program is ready for implementation.